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ABSTRACT

This document chronicles the development of a hypermedia CD-ROM product that offered information on the island of Cyprus. The hypermedia environment was designed for use by students and educators in eleventh grade up to the college level, and it was intended to fill gaps in multicultural knowledge by enabling individualized, self-paced instruction in engaging multiple formats. The development process was divided into several stages: (1) deciding on the degree of interactivity, or number of hyperlinks and layers of choices; (2) designing the main interface; (3) creating flowcharts to depict and plan for possible user paths; (4) storyboarding; (5) collection of informational material such as photographs, maps, drawings, sounds, music, and bits of animation; and (6) the actual authoring of the CD-ROM. The prototype was reviewed by instructional designers, multimedia developers, graphic artists, and content experts, while students offered feedback on the revised final version. Design lessons learned include the need for keeping the interface simple and navigable, using color meaningfully and consistently, taking extra time for selection of software tools and for content analysis, and working with a team of experts. (Contains 15 references.) (BEW)

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The Development Of An Interactive Multimedia CD-ROM: Lessons Learned

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by Charalambos Vrasidas
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Description of the Project

Cyprus Interactive is a hypermedia environment designed to be used as a resource by students and educators that are interested in learning about Cyprus. By clicking buttons and hot-text the learner can navigate through different sections of the project in a non-linear manner. Since the material was not structured in a sequential manner, no specific performance objectives were specified. The users are allowed to explore different aspects and topics about Cyprus. Quicktime movies, sounds, images, maps and textual information were all incorporated in this treatment.

Instructional Design Model

For the development of this project we designed our own model which guided the whole process. This model (see Figure 1) can also be used for the development of similar interactive multimedia treatments. The model was based on other theoretical instructional design models (Dick & Carey, 1990; Smith & Ragan, 1993) as well as on other factors involved during the development of interactive multimedia treatments (Park & Hannafin, 1993; Schwier & Misanchuk, 1993).

Goal Development

Cyprus Interactive had a project oriented goal. Therefore, there were no performance objectives specified. The purpose of this project was to develop a hypermedia environment which would contain information about Cyprus, an island in Mediterranean sea.

General goals:

The two general goals set for this project were: (1) the learner will have a greater appreciation for the culture and people of Cyprus, and (2) after exploring the world of Cyprus through this hypermedia program the learner will have a greater understanding and knowledge about Cyprus, the island's geography, people, history and culture.

Target Audience

The target audience of this project were students and educators in grades 11-12 and college level. In addition to identifying the target audience, at this stage it is necessary to also identify the target platform that the CD-ROM will be used. In this case, the target learning environments were those that use Macintosh computers equipped with double-speed CD-ROM players.

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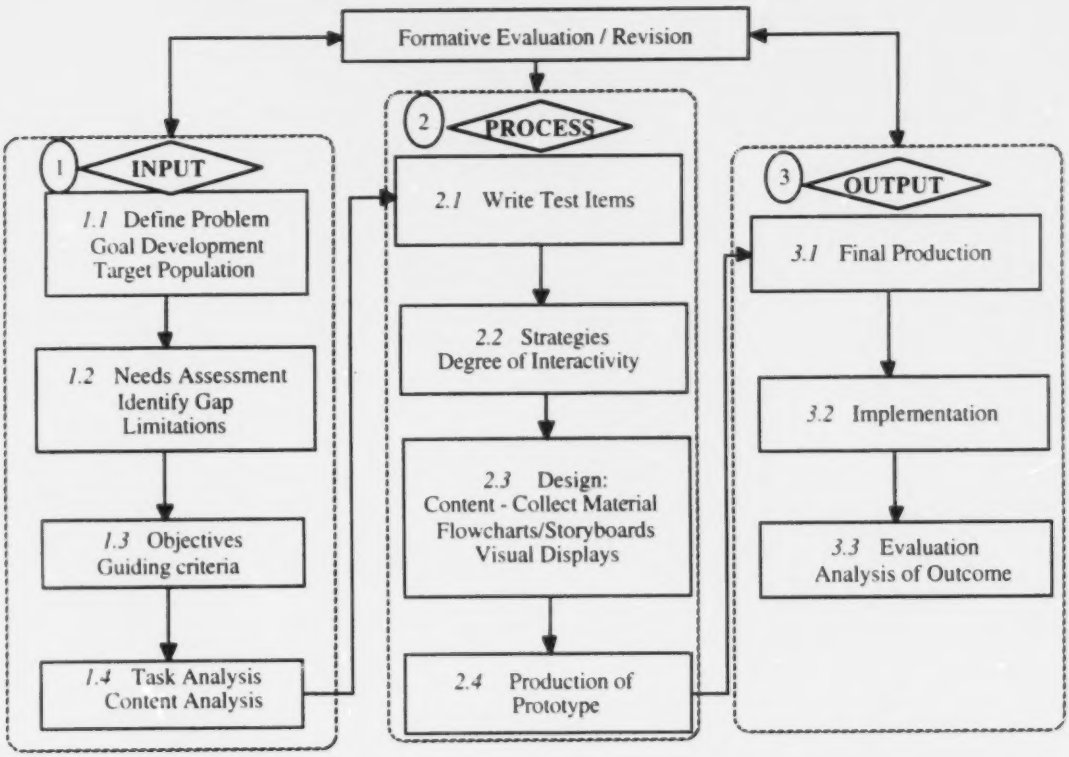
Figure 1
INSTRUCTIONAL DESIGN MODEL USED
FOR THE DEVELOPMENT OF *CYPRUS INTERACTIVE*



Needs Assessment

Needs assessment assists instructional designers in gathering data about the identified problem, which data will drive the instructional design process in a way that it will be effective in improving performance (Rossett, 1991; Burton & Merrill, 1991). Very few students, and even teachers, know much about Cyprus. The gap identified was the lack of knowledge about other countries and cultures. The authors attempted to bridge this gap by creating a hypermedia environment which can make learning more interesting and exciting. The United States is one of the most diverse societies in the world and it is essential that its citizens know about other cultures. Hypermedia environments can be very effective in motivating students to learn.

Emerging technologies are changing the way we communicate and interact with each other. Hypermedia and interactive multimedia are part of these new technologies and they cannot be ignored. With the reduction of costs, due to technological advances, it is feasible for many school districts to develop their own interactive multimedia treatments on many different subjects.

Some of the advantages associated with this particular delivery system are: (1) it enables individualized instruction, (2) students can learn and progress at their own pace, (3) the multimedia nature of this delivery system suggests that

information is presented in more than one mode (verbal, auditory, visual), and (4) it increases motivation. As a result of the advantages listed above, information presented in a hypermedia environment can more easily be retained, remembered and recalled by the learner. Therefore, instruction can be more effective and efficient.

A unit on Cyprus can be used in many areas of the curriculum. It can be linked to World History, Art History, World Geography, and in Multiculturalism. More specifically, the general goal stated for this project fits under the following Illinois State Board's of Education General Goals:

Fine Arts: (a) "As a result of their schooling, students will be able to identify significant works in the arts from major historical periods and how they reflect societies, cultures and civilizations, past and present."

Social Sciences: (b) "As a result of their schooling, students will be able to understand and analyze events, trends, personalities and movements shaping the history of the world, United States and Illinois." (c) "As a result of their schooling, students will be able to demonstrate a knowledge of world geography with emphasis on the United States." (d) "As a result of their schooling, students will be able to apply the skills and knowledge gained in the social sciences to decision making in life situations." (Illinois State Board of Education, 1985).

Constraints - Limitations

The major constrains involved during the development of a hypermedia environment or an interactive multimedia treatment, are the availability of the necessary software, hardware, time, budget, and personnel with the required knowledge and skills to produce the treatment. If there is a substantial budget, then some of the problems related to financial issues are easily overcome. For this project there was no budget. Therefore, the authors had to use the resources available at the time of production.

Decisions relating to software and hardware were based on: (a) what was available, (b) what was the budget for possible purchases, (c) knowledge of certain software and hardware, and (d) time available to develop the final product.

Task - Content Analysis

Once the general goal of the project and the target population were identified, and the needs assessment was conducted the next step was the content analysis.

Cyprus Interactive is mainly project oriented. The main analysis conducted was content analysis. In order to facilitate the content analysis process we begun with a content outline. The content outline was used to break down the content into small chunks that could be addressed independently. During the organization of the content outline, the various menus and submenus emerged. This process was particularly helpful for the following reasons: (1) saved a lot of time during the scripting, flowcharting and storyboarding, (2) helped in identifying missing and/or unnecessary information, (3) helped in organizing the content in a meaningful and easy to understand manner, (4) allowed quick reviews and revisions of the material, and (5) assisted in the identification of basic concepts from every smaller unit.

After the content outline, simple statements were assigned - in the form of objectives - to every menu and submenu. These statements were used to identify basic concepts related to the content area that needed to be addressed.

Design and Development

The design and development process was divided into the following interdependent stages:

(1) Degree of Interactivity

Decisions on the degree of interactivity and the options that would be provided to the learner at every menu were made during this stage. (a) the six options (Introduction, Geography, History, People, Other, Help) were always accessible at any time (except when the user was within the Help menu), (b) the "Quit " option is available all the time at every display, and (c) the submenu navigation consisted of the following buttons: Previous Menu, Find, Recent Pages, Previous Page, Next Page. Brief descriptions of the major buttons follows: (1) the "Previous" and "Next Page" buttons allow the user to backtrack or proceed one page at a time within a specific submenu, (2) the "Previous Menu" button allows the user to go back to the previous menu within which the submenu he is already in is located, (3) "Find" and "Recent Pages" buttons allow the user to go to places they already visited, or do a search for specific topics, and (4) the "Help" button provides on-line information on how to use the program. When the users exit help, they return to the display they were before accessing help.

Pull down menus include the following options: Restart, Print, About Cyprus Interactive(with credits), Quit, Write Notes, Read Notes, Final Test. For more information on the degree of interactivity, navigation and designing hypermedia environments, refer to Nielsen (1993), Stevens & Stevens (1995), Semraou & Boyer, 1994, and Park & Hannafin, (1993).

(2) Design of the Main Interface

The design of the interface began at the very beginning of the whole development process and it was constantly revised until the final production. The interface was designed so that it would: (a) be clean, readable, simple and easily understood, (b) be consistent with regards to the location of buttons and special information provided on the screen, (c) be aesthetically pleasing, (d) use colors and graphics that would not distract from the content.

(3) Flowcharting and Navigation

The authors drew out flowcharts indicating the options and branching that would be allowed at any part of the program. These flowcharts were mainly focused on the basic options provided to the user at any given time. This was not a detailed flowchart. The difficulty with flowcharts when developing a hypermedia environment is that you cannot depict all possible paths graphically because the learner can at any point go anywhere in the project.

(4) Storyboarding

Having all the steps above in mind, the authors proceeded with the storyboarding. Graphics, sounds, movies, maps and textual information were assigned to every display. This was a rough draft because during the authoring process things were rearranged. The storyboarding process provided a list of the different kinds of materials that would be needed and created a list of photos, maps, movies, sounds and text that were used. This saved a lot of time because it enabled the authors to avoid gathering materials that would not be used.

(5) Collection of the Material

During this stage libraries were created for all the different kinds of media that were used.

(a) Photographs. Some of the photographs were scanned from printed

materials and others were captured from slides and videotapes. All of the photographs used were converted to 8 bit color/or grayscale PICT files. The photos were sized and assigned borders in Photoshop.

(b) Maps & Drawings. Maps and Clip-Art were used which were cleaned up in Photoshop and Illustrator. Drawings were done in Photoshop and Illustrator using a Wacom drawing tablet.

(c) Sounds and music were captured at the best quality (16 Bit, 44 MHz) and converted into SoundEdit 16 Pro, (8 Bit, 22 MHz, AIFF format).

(d) Quicktime movies & Animation. Movies were captured using Adobe Premiere and a Radius Video vision card from VHS videotapes. They were captured at the following specifications: 320x240 pixels, Radius hardware compression, Best Quality, 16 Bit 22 MHz audio. Then, titles and transitions were added and rendered to the following specifications: 240X180, Cinepak compression, data rate limited up to 190K per second, and audio compressed down to 8 bit 22 MHz. When planning to use quicktime movies on a CD-ROM, the best compression to use is Cinepak. Also, limit the data rate to 190k per second, when targeting double speed CD-ROMs.

It is advisable that, both audio and video, be captured at the highest quality possible and then down-sampled accordingly. In this way one can get the best quality possible out of the original materials (Heid, 1995; Stern & Lettieri, 1994). Animations were created using Authorware Professional's built-in capabilities.

(e) Text. Serif fonts are easier to read than sans serif and lower case type is also easier to read than upper case (Winn, 1993; Pettersson, 1989). Four different kinds of text were used. The main text was Times, black, plain, 15 points. The hot-text was Times, bold, blue, 15 points. The captions were Helvetica, brown, plain, 11 points in size. The titles we were Helvetica, bold, black, and size 16 points.

(6) Authoring stage.

During this stage the prototype was developed that went through many changes. Feedback was received from students, colleagues and educators. For the selection of the authoring tool used for this project the following software were reviewed: Macromedia's Director 4.0.4, Authorware Professional 3.0, Supercard, Hypercard, and Digital Chisel. The final decision was guided by the following criteria: (a) what were the program's capabilities in importing and exporting graphics, sounds, text, movies and animations, (b) was it necessary to learn any programming language in order to create applications? (c) how easy was the program to learn and use? (d) integration of peripherals: could laserdiscs and VCRs be controlled with this program? (e) were the drivers necessary for controlling peripherals provided? (f) what types of interactivity could be created? (g) could stand alone applications be created?(h) documentation: how well were the manuals written, and what was the technical support like? (I) could students' branching and answers be tracked and stored in external files (j) was a text editor and a painting palette included, and (k) was the software cross-platform? The software finally used for the authoring stage was Macromedia's Authorware Professional.

Authorware is an object-oriented authoring tool that doesn't require the use of any complicated scripting language in order to create applications. One of the strongest features of object-oriented

authoring tools is that icons on the flowchart can very easily be changed and updated. You can also create various kinds of models that you can copy and paste as many times as desired on your flowchart, which can save a lot of time. Different levels of hierarchy can also be created with maps which allow the designer to see at a glance the structure of the whole application. Custom and system variables and functions, importing text, sounds, video, and movies, creation of animations, control of peripherals, networkablity, and the most important, ease of use are some of the features that make Authorware a very powerful authoring tool. In addition to the above, very easily the instructional designer can store the answers of the learner in an external file and even track the exact branching each individual followed.

Additional reasons for choosing APM 3.0 included the following: (1) the authors were already familiar with older versions of the software, (2) WIU already had copies available in the multimedia lab, and (3) Authorware is a cross-platform software. Files created on the Macintosh platform can easily be converted into Windows environments and vice-versa.

Final Production

After the prototype was tested and revised many times the authors proceeded with the final production. Some special steps that were followed in order to get the best performance out of the CD-ROM were: (1) all the files were checked with Norton Utilities to ensure that there were no viruses and corrupted files, (2) all the files were defragmented, (3) quicktime movies were compressed using Cinepak compression and with data rate limited to 190K (for double-speed CD-ROM players), (4) sounds used were saved as 8 bit, 22 MHz, and (5) photographs and graphics were also saved as 8 bit files.

Formative Evaluation

Dick and Carey (1991) argued that one of evaluation's major aims is to collect data that would guide the decision making process. Formative evaluation was a part of the development process. The treatment was constantly tested and revised in order to maintain an alignment between the three main stages of instructional development. Students, colleagues, producers, and educators tried the project and gave their opinions and feedback about the structure, content, navigation and interface. The processes of evaluation and revision were continuous. The best way to test instructional materials is to have the learners try them during the development process and get feedback from them. According to Smith and Ragan (1993) the four phases of formative evaluation are: "(1) design reviews, (2) expert reviews, (3) learner validation, and (4) ongoing evaluation" (p. 389).

Design Reviews

Before the actual production of the CD-ROM, the instructional design model was revised several times in order to assure alignment between the Input, the Process and the Output components. Questions that were addressed during this stage included: (a) Does the goal fit within the curriculum? (b) Is this treatment appropriate for bridging the gap identified in the needs assessment? (c) Are the content and approach used appropriate for the target learners?

Expert Reviews

Before the final production, the prototype was reviewed by experts in every area that was involved in the whole process. Instructional designers, multimedia developers, graphic artists, and content experts went through the prototype and gave valuable feedback.

Learner Evaluations

Twelve college students tried out

the CD-ROM and gave their opinion and feedback regarding the language used, navigation controls, the content, and the interface. Suggestions from the students were very valuable. The authors found out that in many instances they falsely assumed that the learner will know how to move from one section to the other. After the one-to-one validation with the students revisions were made to incorporate more clear instructions and navigation controls.

Lessons Learned

Working on this project was a great learning experience. Lessons learned from the whole process of developing the *Cyprus Interactive* CD-ROM include the following:

(1) Start with something simple.

(2) Always allow more time and plan ahead. Allow plenty of time for revision.

(3) Keep the screen simple and consistent. Do not overload with too much information. Provide ample white space.

(4) Use color consistently and in a meaningful way (green for go, red for stop, hot text always blue, etc.).

(5) Always give the learner the option to move back, exit, quit, and access help.

(6) Authoring for a CD-ROM and authoring for smaller applications that would be running from a hard-drive have some differences that will affect the performance of your program.

(7) Select the appropriate authoring tool. If you plan to keep records of the learners performance use a program that does that without requiring major scripting.

(8) Spend enough time in the content analysis, flowcharting and storyboarding. It is very helpful and it will save you a lot of time in the long-run.

(9) Do not allow too many options on the same screen. It makes the authoring stage very hard. Keep it simple and allow them only a few basic options at a time.

(10) It is very important to work with a team. The team for any multimedia or hypermedia project should include an instructional designer, a graphics artist, a content expert and the producer who will put all the pieces together. This allows the time to everyone of the members of the team to focus in their area and be more effective and efficient.

Software used: Authorware Professional 3.0, Adobe Photoshop 3.0, Adobe Illustrator 5.5, Strata vision 3d, Adobe Premiere 4.0.1, SoundEdit 16, Microsoft Word 5.1, Mirror Scan software, Omni page Professional, Fetch 1.2.

Hardware: PowerMac 7100 AV. - 36MB RAM, Quadra 840 AV. - 40MB RAM, Radius Video vision Card, 13" Audiovision Apple monitor, Sony CDW-900E Recorder, Wacom drawing tablet.

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